Nelson City Council
te kaunihera ō whakatū

Conhur
www.conhur.com

NELSON CITY COUNCIL

Bell Island Treatment Ponds Sludge Survey Report

June 2014

Commercial in Confidence

CONHUR LTD
PO BOX 204021
Highbrook Mail Centre
East Tamaki
34 Oakleigh Avenue
Takanini, Auckland
Ph 09 278 7109
Fax 09 278 7108
www.conhur.com

Table of Contents

1. INTRODUCTION

Conhur provides sludge surveys for both sludge lagoons and oxidation ponds. We utilize the latest technology to provide as accurate a result as possible. Our sludge surveys provide estimates of:

- The volume of sludge contained within the ponds
- The average solids content of the sludge contained in the ponds
- The total tonnes dry solids (tDS) contained within the ponds

Conhur was contracted by Nelson City Council to survey the sludge contained in the three facultative ponds and two maturation ponds at the Bell Island WWTP. The survey was undertaken over a period of two days from 9 to 10 November 2014 in wet, calm weather conditions. This was a follow up to an original survey completed by Conhur in November 2012.

2. METHODOLOGY

Pond Base survey

The bases of the Ponds were surveyed utilizing high accuracy GPS equipment and integrated topographic software. This survey was carried out from a survey boat on the ponds. The ponds were surveyed on grid system with survey points at 25m centres.

For this sludge survey, the GPS coordinate system used was NZGD2000, NZ Transverse Mercator. The reduced levels provided are relative only and have not been calibrated against known survey reference heights.

For the 2014 survey it was found that the pond water surface levels were generally lower than in 2012. This accounts for the difference in average depths and total pond volumes in 2014.

Sludge water interface

The level of the sludge water interface was measured utilizing a Royce 711 suspended solids interface meter. This tool provides an accurate indication of the level of the top of the sludge. Conhur recorded this information with high accuracy GPS equipment and integrated topographic software. This survey was carried out from a survey boat on the ponds and provides a reasonably accurate profile of the top of the sludge layer.

Sludge Volume

The sludge volume within the ponds was calculated by comparing the base surveys and the surveys of the top level of the sludge. This calculation is carried out by the topographic survey software and enables the production of both cross sections through the ponds and plan profiles of the sludge within the ponds.

Sludge Samples

Conhur utilized a purpose built grab sample tube to recover sludge samples from within each of the ponds. The sample tube has proven to provide the best method of sludge sample retrieval.

Ten samples were retrieved at specific sludge survey locations on each pond. The retrieval of intact, undisturbed insitu sludge samples from treatment ponds is a difficult process and does not provide 100% accurate results. This is especially true when the sludge layer is less than 500mm deep. Conhur Ltd has made every attempt and used best industry practice to retrieve representative samples, however we cannot guarantee accuracy of the solids analysis results.

Sludge Sample Analysis

The fifty individual sludge samples retrieved were sent to the Watercare Services Ltd Laboratory in Auckland for total solids testing. The results are provided in Section 4 of this report and appended.

In addition, two composite sludge samples were prepared for each Facultative Pond and 1 composite sludge sample was prepared from each Maturation Pond. The composite samples were also sent to the Watercare Services Ltd Laboratory and tested for volatile solids, heavy metals and nutrient concentration. The results are provided in Section 5 of this report and appended.

3 SITE PHOTOGRAPHS

Bell Island WWTP Aerial View

Facultative Ponds F3 and F2 (right) on the day of the survey

Facultative Pond F1

4. SLUDGE SURVEY RESULTS

Maturation Pond M1

The RL of the pond water surface when surveyed was 23.20m in Pond M1. This level relates to the top of concrete of the outlet structure at the NE end of Pond M1, which was measured as RL 23.54m.

The average depth to the pond base from the water surface is 1.38m.

The total volume of the pond is estimated to be 137,670m^3.

The average depth to the sludge surface from the water surface is 1.17m.

The average depth of sludge in the pond is 0.21m.

The maximum depth of sludge in the pond is 0.440m.

The total volume of sludge in the pond is estimated to be 18,430m^3.

The weighted average solids contents of the 10 samples retrieved was 0.7%

Based on the above we estimate that Pond M1 contains approximately 129 dry tonnes (tDS) of sludge.

The solids contents of the 10 samples retrieved from Maturation Pond M1 were as follows:

Sample M1-1	1.8%
Sample M1-2	0.2%
Sample M1-3	1.1%
Sample M1-4	0.2%
Sample M1-5	0.2%
Sample M1-6	0.2%
Sample M1-7	1.4%
Sample M1-8	1.2%
Sample M1-9	0.2%
Sample M1-10	0.4%

Maturation Pond M5

The RL of the pond water surface when surveyed was 22.64m in Pond M5. This level relates to the top of concrete of the access platform at the south end of Pond M5, which was measured as RL 23.00m.

The average depth to the pond base from the water surface is 0.91m.

The total volume of the pond is estimated to be 90,570m^3.

The average depth to the sludge surface from the water surface is 0.82m.

The average depth of sludge in the pond is 0.09m.

The maximum depth of sludge in the pond is 0.340m.

The total volume of sludge in the pond is estimated to be 9,910m^3.

The weighted average solids contents of the 10 samples retrieved was 1.4%

Based on the above we estimate that Pond M5 contains approximately 139 dry tonnes (tDS) of sludge.

The solids contents of the 10 samples retrieved from Maturation Pond M5 were as follows:

Sample M5-1	2.2%
Sample M5-2	0.1%
Sample M5-3	0.3%
Sample M5-4	4.0%
Sample M5-5	0.5%
Sample M5-6	0.2%
Sample M5-7	2.4%
Sample M5-8	0.9%
Sample M5-9	0.2%
Sample M5-10	3.0%

Facultative Pond F1

The RL of the pond water surface when surveyed was 23.46m in Pond F1. This level relates to the top of concrete of the access platform at the north end of Pond F1, which was measured as RL 23.82m.

The average depth to the pond base from the water surface is 1.56m.

The total volume of the pond is estimated to be 155,320m^3.

The average depth to the sludge surface from the water surface is 0.99m.

The average depth of sludge in the pond is 0.57m.

The maximum depth of sludge in the pond is 1.15m.

The total volume of sludge in the pond is estimated to be 52,340m^3.

The weighted average solids contents of the 10 samples retrieved was 2.9%

Based on the above we estimate that Pond F1 contains approximately 1,518 dry tonnes (tDS) of sludge.

The solids contents of the 10 samples retrieved from Facultative Pond F1 were as follows:

Sample F1-1	3.7%
Sample F1-2	4.5%
Sample F1-3	4.5%
Sample F1-4	5.2%
Sample F1-5	0.7%
Sample F1-6	1.2%
Sample F1-7	0.3%
Sample F1-8	2.9%
Sample F1-9	3.1%
Sample F1-10	2.8%

Facultative Pond F2

The RL of the pond water surface when surveyed was 23.57m in Pond F2. This level relates to the top of concrete of the access platform at the north end of Pond F2, which was measured as RL 23.86m.

The average depth to the pond base from the water surface is 1.78m.

The total volume of the pond is estimated to be 176,810m^3.

The average depth to the sludge surface from the water surface is 1.09m.

The average depth of sludge in the pond is 0.70m.

The maximum depth of sludge in the pond is 1.35m.

The total volume of sludge in the pond is estimated to be 66,240m^3.

The weighted average solids contents of the 10 samples retrieved was 4.8%

Based on the above we estimate that Pond F2 contains approximately 3,180 dry tonnes (tDS) of sludge.

The solids contents of the 10 samples retrieved from Facultative Pond F2 were as follows:

Sample F2-1	3.8%
Sample F2-2	3.5%
Sample F2-3	4.4%
Sample F2-4	4.6%
Sample F2-5	5.5%
Sample F2-6	6.3%
Sample F2-7	5.2%
Sample F2-8	5.1%
Sample F2-9	4.6%
Sample F2-10	2.5%

Facultative Pond F3

The RL of the pond water surface when surveyed was 23.61m in Pond F3. This level relates to the top of concrete of the access platform at the north end of Pond F3, which was measured as RL 23.90m.

The average depth to the pond base from the water surface is 1.69m.

The total volume of the pond is estimated to be 169,760m^3.

The average depth to the sludge surface from the water surface is 1.11m.

The average depth of sludge in the pond is 0.58m.

The maximum depth of sludge in the pond is 1.20m.

The total volume of sludge in the pond is estimated to be 52,900m^3.

The weighted average solids contents of the 10 samples retrieved was 3.5%

Based on the above we estimate that Pond F3 contains approximately 1,852 dry tonnes (tDS) of sludge.

The solids contents of the 10 samples retrieved from Facultative Pond F3 were as follows:

Sample F3-1	0.1%
Sample F3-2	3.1%
Sample F3-3	2.9%
Sample F3-4	3.6%
Sample F3-5	4.0%
Sample F3-6	3.3%
Sample F3-7	2.9%
Sample F3-8	2.8%
Sample F3-9	3.4%
Sample F3-10	4.7%

BELL ISLAND TREATMENT PONDS SLUDGE SURVEY

Sludge Survey Summary Table

Pond	Water Level (m)	Avg. Pond Depth (m)	Avg. Depth to Sludge (m)	Avg. Sludge Depth (m)	Max. Sludge Depth (m)	Est. Total Pond Volume (m^3)	Est. Sludge Volume (m^3)	Weighted Average Sludge Solids Content	Est. Tonnes Dry Solids (tDS)
M1	23.20	1.38	1.17	0.21	0.44	137,670	18,430	0.7%	129
M5	22.64	0.91	0.82	0.09	0.34	90,570	9,910	1.4%	139
F1	23.46	1.56	0.99	0.57	1.15	155,320	52,340	2.9%	1,518
F2	23.57	1.78	1.09	0.70	1.35	176,810	66,240	4.8%	3,180
F3	23.61	1.69	1.11	0.58	1.20	169,760	52,900	3.5%	1,852

5. COMPOSITE SLUDGE SAMPLE ANALYSIS

Two composite samples from each Facultative Pond and one composite sample from each Maturation Pond were prepared from the individual samples retrieved. The composite samples were sent to Watercare Services' Laboratory for composition, nutrient and volatile solids analysis.

The Maturation Pond composite samples were prepared from all of the individual samples from each pond.

The Facultative Pond composite samples were prepared from half of the individual samples from each pond.

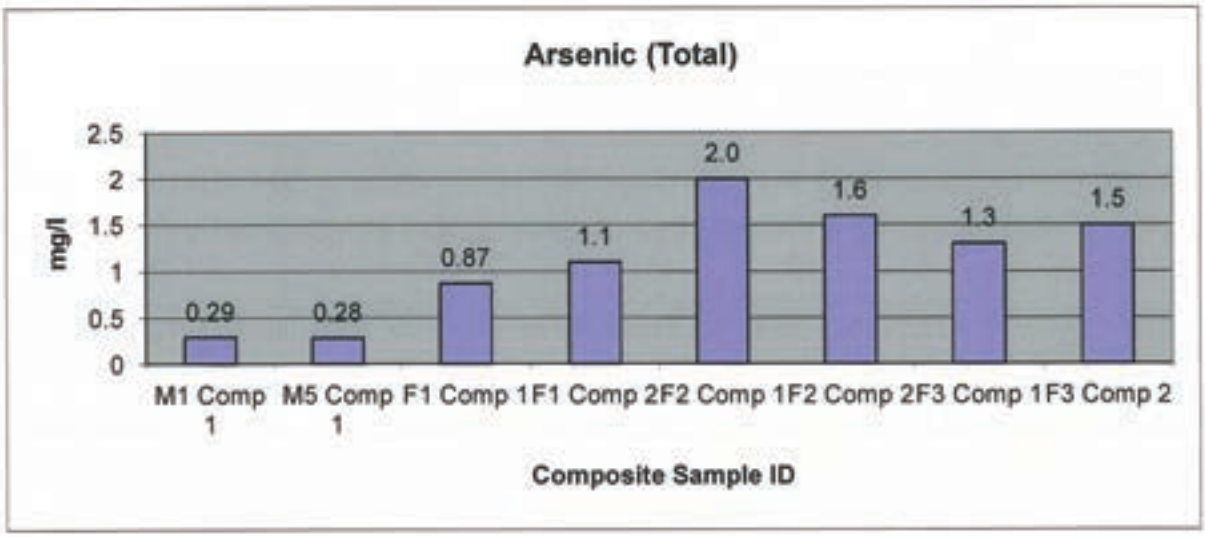
The make-up of the composite samples is as follows:

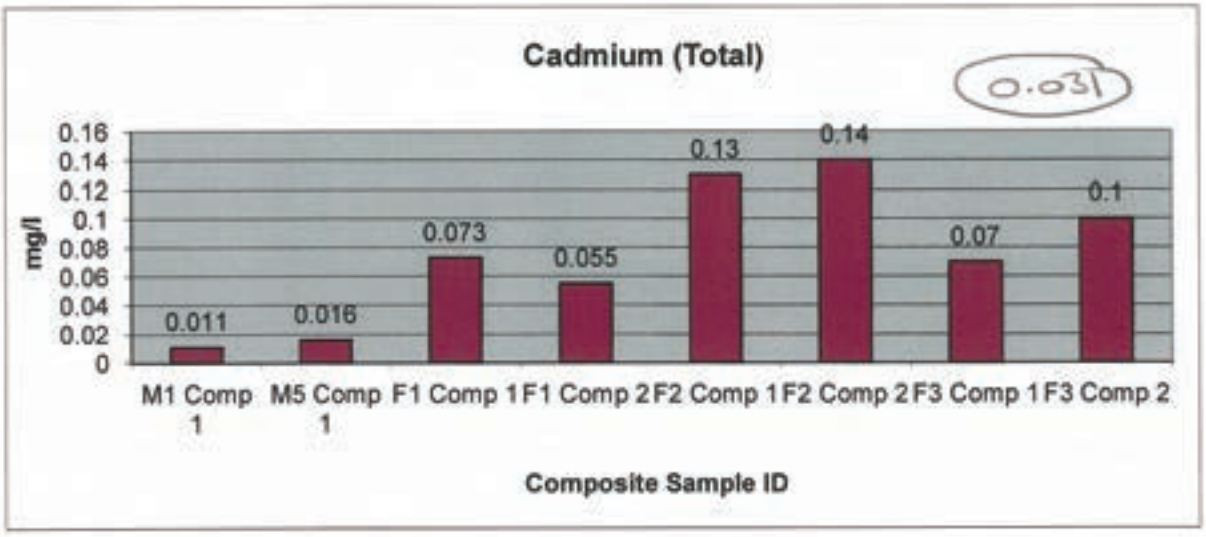
Pond ID	Composite Sample ID	Individual Samples making up the Composite Sample
M1	M1 Comp 1	M1-1 to M1-10
M5	M5 Comp 1	M5-1 to M5-10
F1	F1 Comp 1	F1-1, F1-2, F1-3, F1-4, F1-5
	F1 Comp 2	F1-6, F1-7, F1-8, F1-9, F1-10
F2	F2 Comp 1	F2-1, F2-2, F2-3, F2-4, F2-5
	F2 Comp 2	F2-6, F2-7, F2-8, F2-9, F2-10
F3	F3 Comp 1	F3-1, F3-2, F3-3, F3-4, F3-5
	F3 Comp 2	F3-6, F3-7, F3-8, F3-9, F3-10

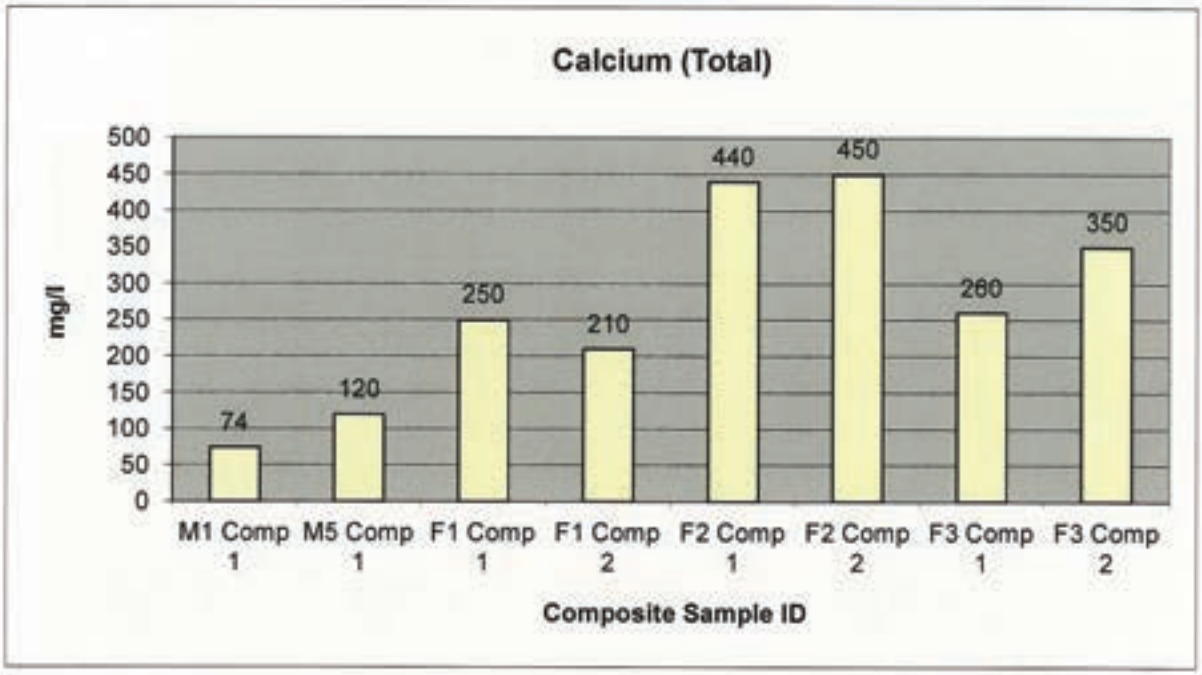
The composite sample testing undertaken was as follows:

- Heavy Metal Screening: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc
- Nutrient Testing: Calcium, Nitrogen, Phosphorous, Ammonium Nitrogen
- Volatile Solids (including Total Suspended Solids)

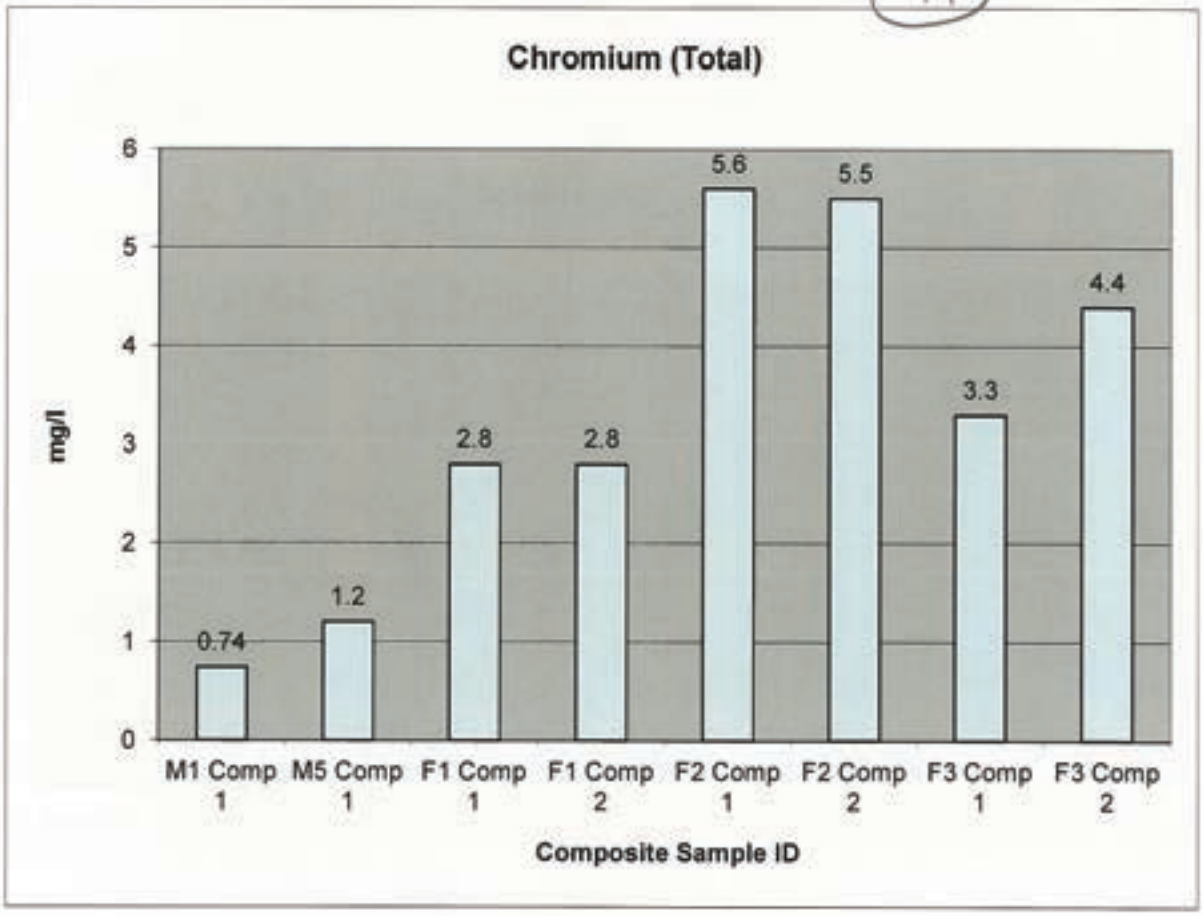
Graphical representation of each test follows, and the Watercare results report is appended.


Arsenic (Total)
mg/l
2.5
2
1.5
1
0.5
0
0.29
0.28
0.87
1.1
2.0
1.6
1.3
1.5
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Cadmium (Total)
mg/l
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.011
0.016
0.073
0.055
0.13
0.14
0.07
0.1
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID

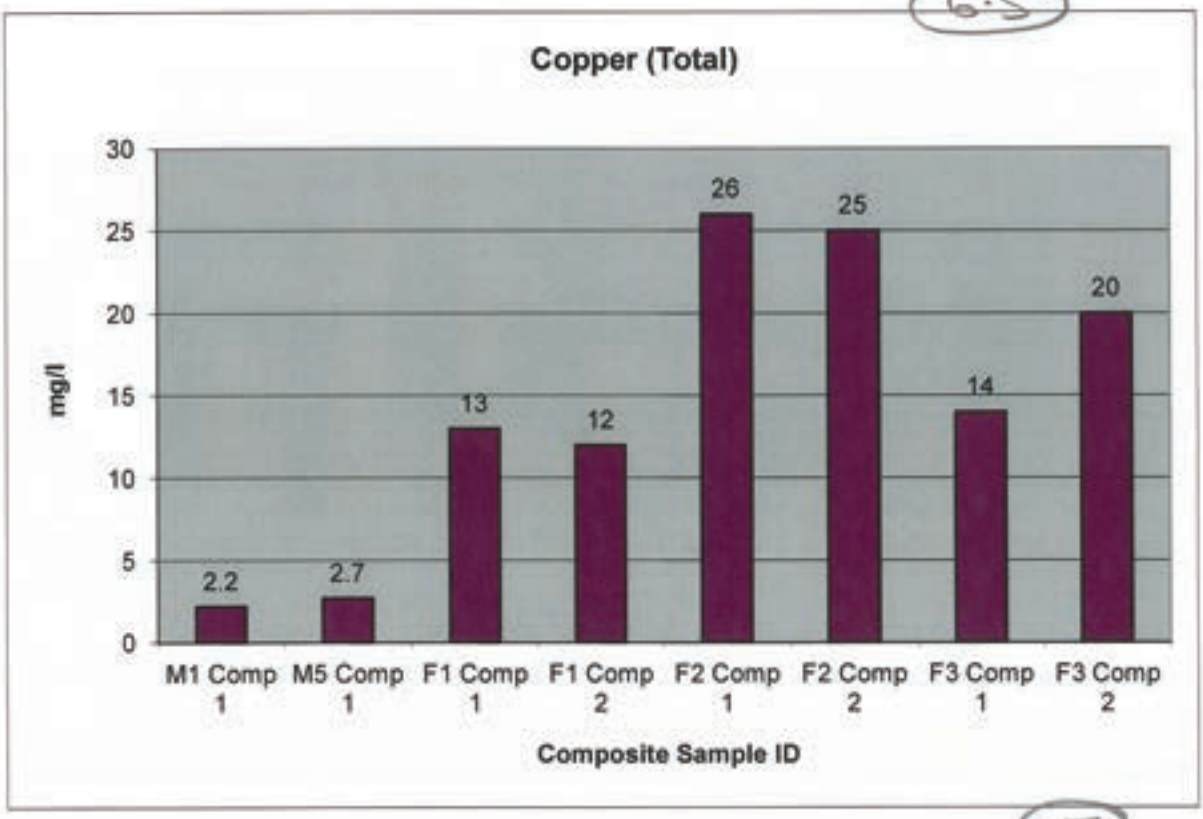

Calcium (Total)
mg/l
500
450
400
350
300
250
200
150
100
50
0
74
120
250
210
440
450
260
350
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID

1-1

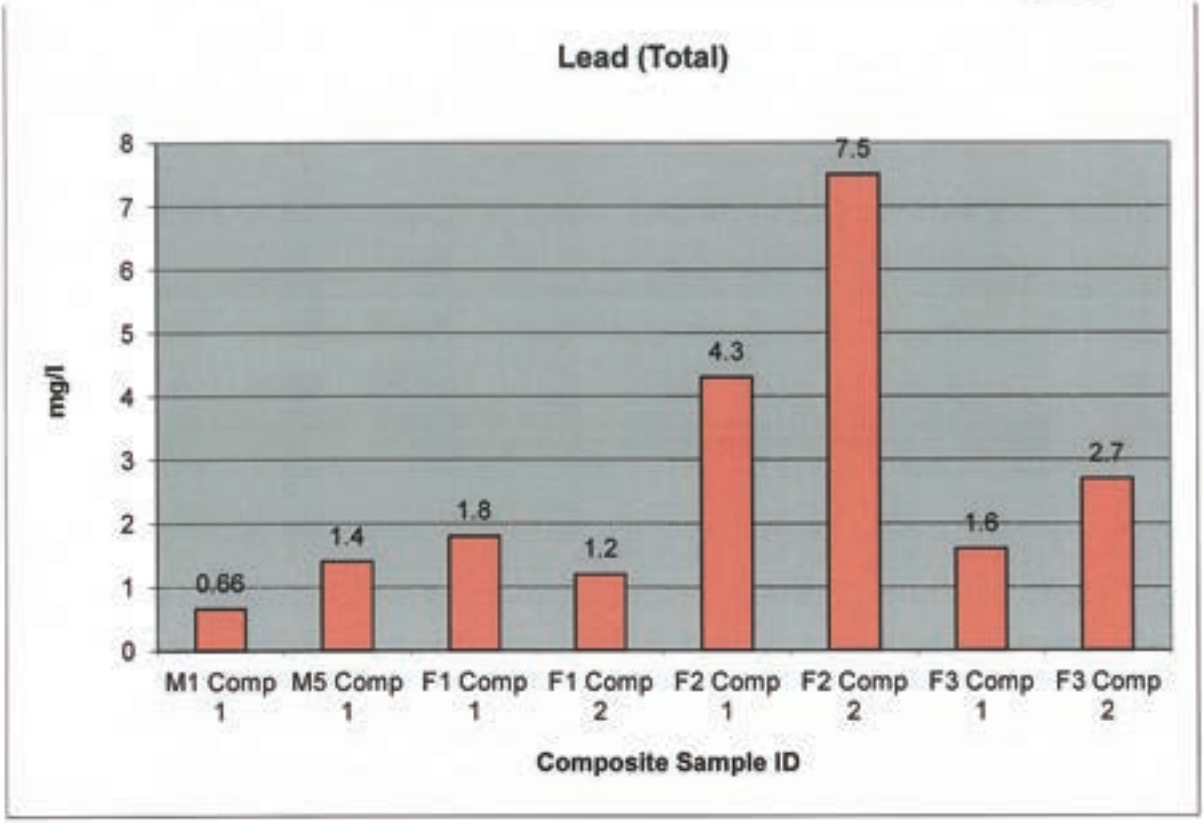

Chromium (Total)
mg/l
6
5
4
3
2
1
0
0.74
1.2
2.8
2.8
5.6
5.5
3.3
4.4
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID

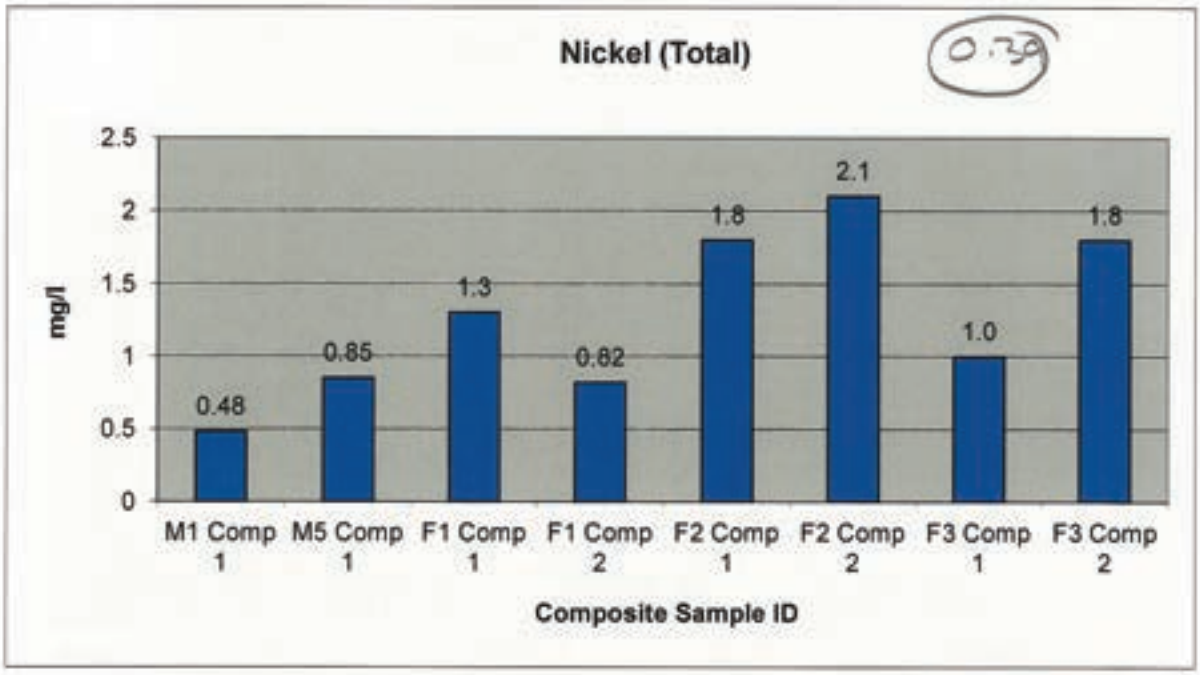
BELL ISLAND TREATMENT PONDS SLUDGE SURVEY

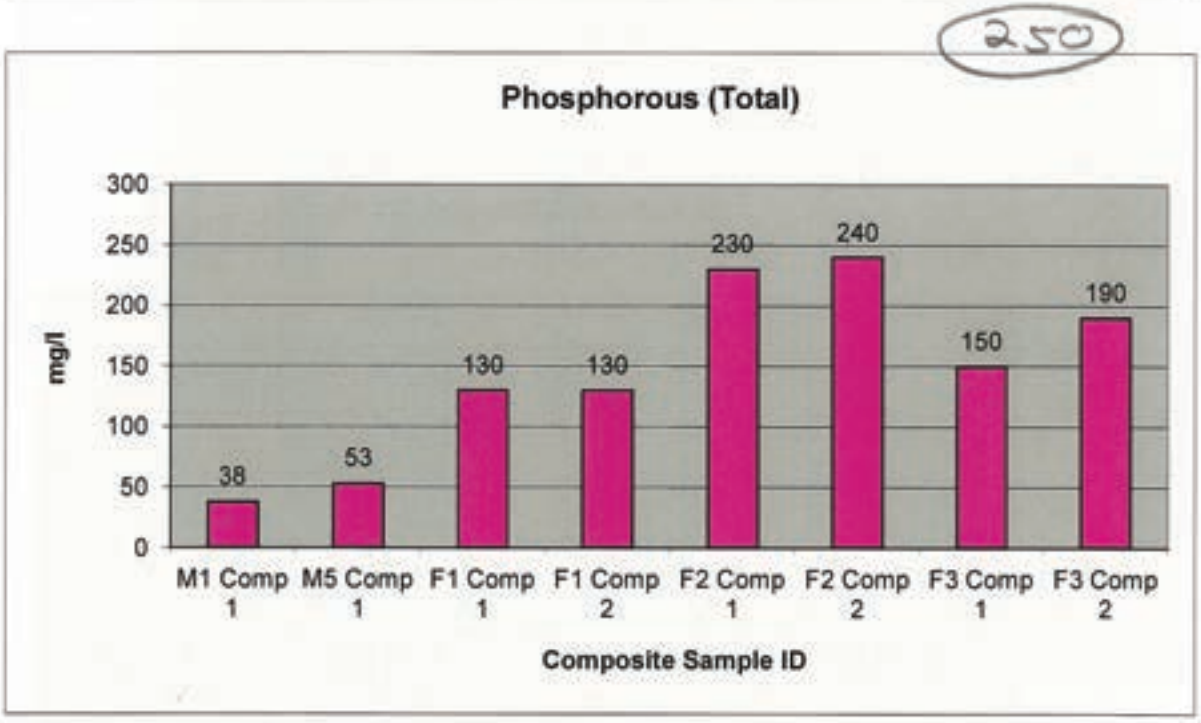
6.5

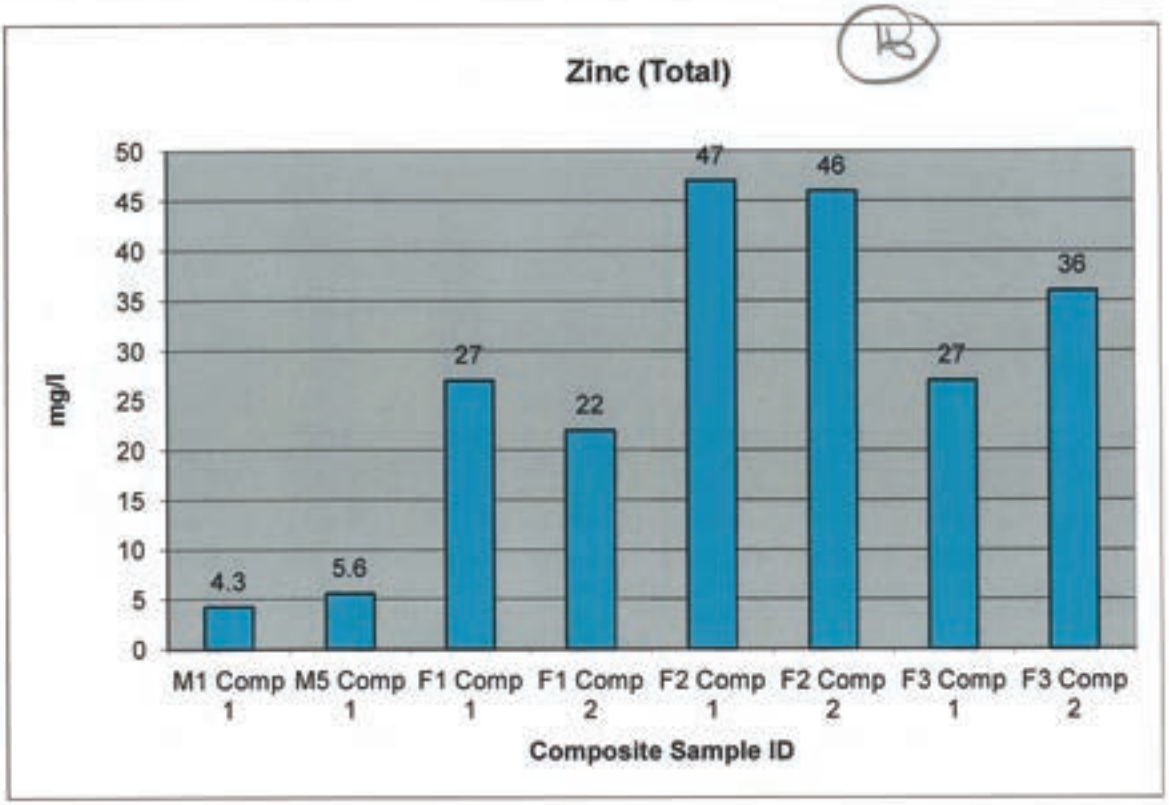


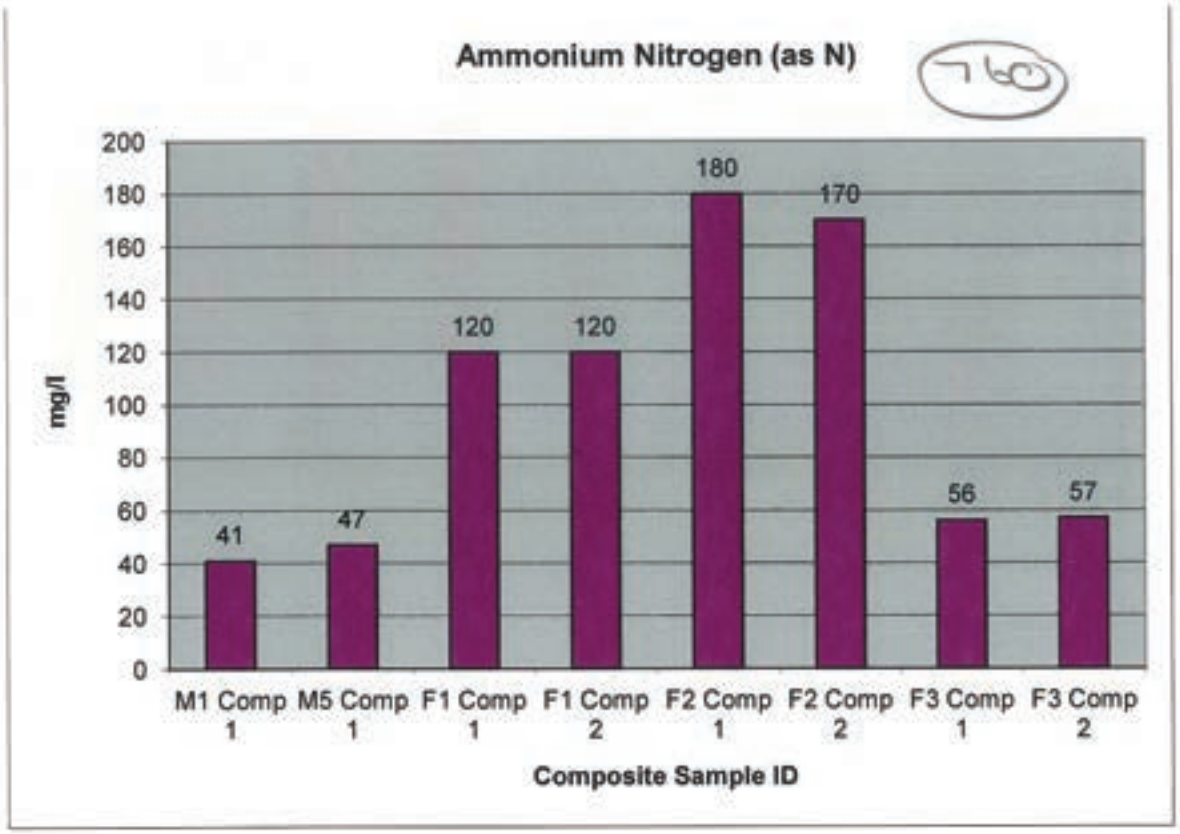
0.71

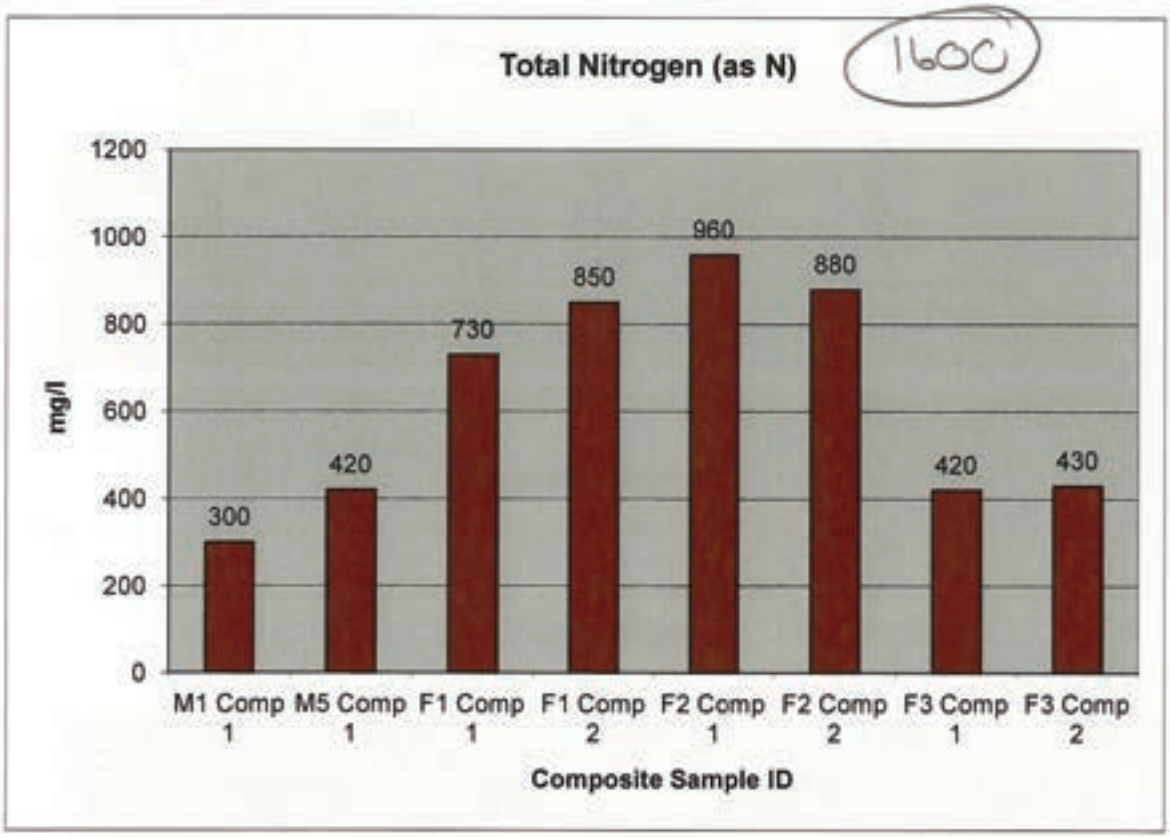


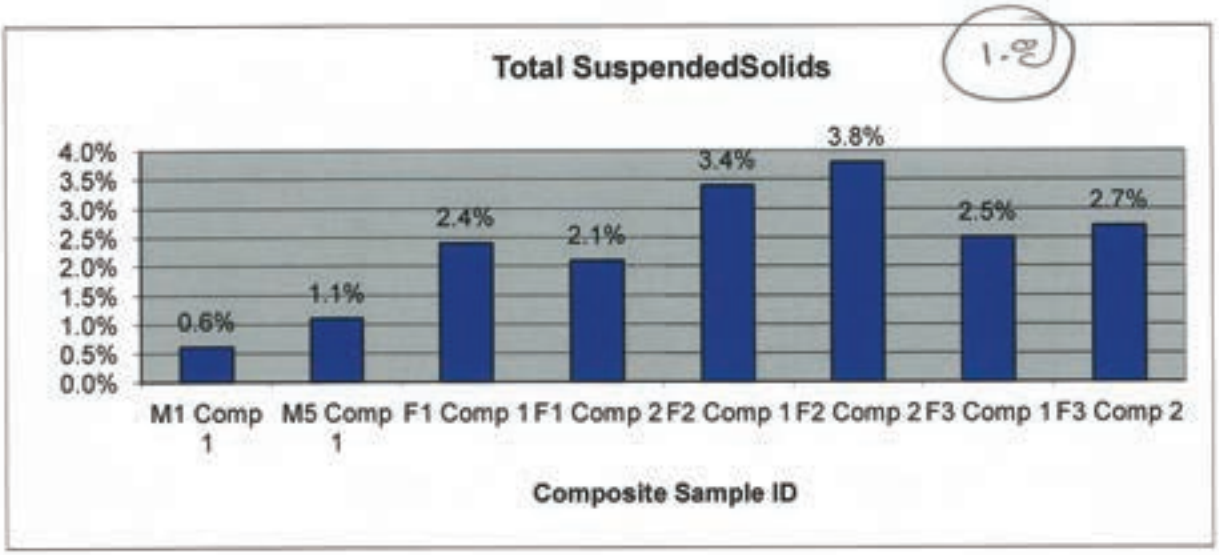

Nickel (Total)
0.39
mg/l
2.5
2
1.5
1
0.5
0
0.48
0.85
1.3
0.82
1.8
2.1
1.0
1.8
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID

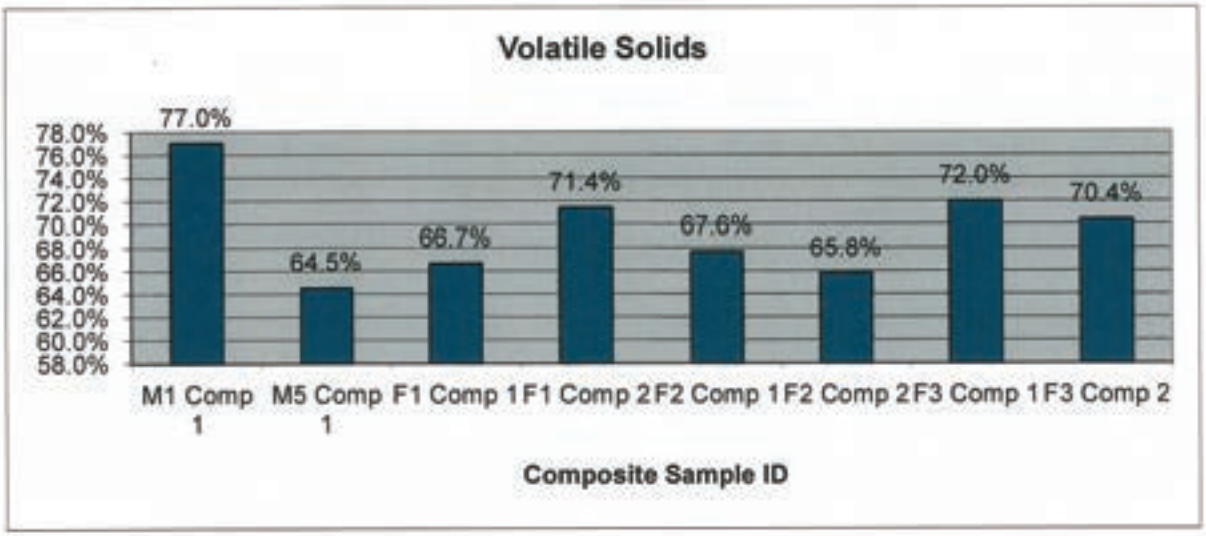

250
Phosphorous (Total)
mg/l
300
250
200
150
100
50
0
38
53
130
130
230
240
150
190
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Zinc (Total)
mg/l
50
45
40
35
30
25
20
15
10
5
0
4.3
5.6
27
22
47
46
27
36
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Ammonium Nitrogen (as N)
mg/l
200
180
160
140
120
100
80
60
40
20
0
41
47
120
120
180
170
56
57
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Total Nitrogen (as N)
1600
mg/l
1200
1000
800
600
400
200
0
300
420
730
850
960
880
420
430
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Total SuspendedSolids
1-2
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
0.6%
1.1%
2.4%
2.1%
3.4%
3.8%
2.5%
2.7%
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID


Volatile Solids
78.0%
76.0%
74.0%
72.0%
70.0%
68.0%
66.0%
64.0%
62.0%
60.0%
58.0%
77.0%
64.5%
66.7%
71.4%
67.6%
65.8%
72.0%
70.4%
M1 Comp 1
M5 Comp 1
F1 Comp 1
F1 Comp 2
F2 Comp 1
F2 Comp 2
F3 Comp 1
F3 Comp 2
Composite Sample ID

6 CONCLUSION

Maturation Pond M1:

The survey confirms the volume of sludge in Pond M1 is approximately 18,430m^3, spread reasonably evenly around the pond with an average sludge depth of 210mm, to a maximum 440mm sludge depth.

Due to the sludge layer being very thin it was difficult to retrieve representative sludge samples. This is reflected in the average solids content being so low. The sludge samples retrieved from the pond indicate that the average solids content is 0.7%. This is very low for sewage sludge but is probably to be expected from a Maturation Pond, being the last treatment process.

Based on the above, we estimate that Maturation Pond M1 contains approximately **129 dry tonnes (tDS)** of sludge, which equates to Pond M1 being approximately 13% full of sludge.

Maturation Pond M5:

The survey confirms the volume of sludge in Pond M5 is approximately 9,910m^3, spread reasonably evenly around the pond with an average sludge depth of 90mm, to a maximum 340mm sludge depth.

The effect the solids content has on the dry tonnes is significant here as there was actually more sludge by volume in M1 than in M5, yet the tonnes dry solids in each have worked out the opposite way around. The margin of error in the solids analysis is likely to be much greater than normal in the Maturation Ponds due to difficulties in retrieving representative samples from thin sludge layers.

The sludge samples retrieved from the pond indicate that the average solids content is 1.4%. This is very low for sewage sludge but is probably to be expected from a Maturation Pond, being the last treatment process.

Based on the above, we estimate that Maturation Pond M5 contains approximately **139 dry tonnes (tDS)** of sludge, which equates to Pond M5 being approximately 11% full of sludge.

Facultative Pond F1:

The survey confirms the volume of sludge in Pond F1 is approximately 52,340m³. The heaviest build ups of sludge are at the SE and SW corners of the pond. The average sludge depth over the whole pond is 570mm. The maximum sludge depth is 1,150mm.

The sludge samples retrieved from the pond indicate that the average solids content is 2.9%. Based on Conhurs experience with previous pond surveys, this is at the low end of the normal expected range for sewage sludge which Conhur has found typically falls within 3%-6% depending on sludge depth.

Based on the above, we estimate that Facultative Pond F1 contains approximately **1,518 dry tonnes (tDS)** of sludge, which equates to Pond F1 being approximately 34% full of sludge.

Facultative Pond F2:

The survey confirms the volume of sludge in Pond F2 is approximately 66,240m³. The heaviest build ups of sludge are at the northern end of the pond. The average sludge depth over the whole pond is 700mm. The maximum sludge depth is 1,350mm.

The sludge samples retrieved from the pond indicate that the average solids content is 4.8%. Based on Conhurs experience with previous pond surveys, this is within the normal expected range for sewage sludge which Conhur has found typically falls within 3%-6% depending on sludge depth.

Based on the above, we estimate that Facultative Pond F2 contains approximately **3,180 dry tonnes (tDS)** of sludge, which equates to Pond F2 being approximately 37% full of sludge.

Facultative Pond F3:

The survey confirms the volume of sludge in Pond F3 is approximately 52,900m³. The heaviest build ups of sludge are along the eastern and southern sides of the pond. The average sludge depth over the whole pond is 580mm. The maximum sludge depth is 1,200mm.

The sludge samples retrieved from the pond indicate that the average solids content is 3.5%. Based on Conhurs experience with previous pond surveys, this is within the normal expected range for sewage sludge which Conhur has found typically falls within 3%-6% depending on sludge depth.

1852

Based on the above, we estimate that Facultative Pond F3 contains approximately **1,852 dry tonnes (tDS)** of sludge, which equates to Pond F2 being approximately 31% full of sludge.

34

7. BELL ISLAND TREATMENT PONDS SLUDGE SURVEY DRAWINGS

- Topographical Plan
- Sludge Depth Plan
- Profile Layout
- Cross Sections (Sheets 1-5)

LEGEND

- Sealed Road
- Fence
- Gate
- Aerator
- Survey Mark
- Sludge Sample Location
- Manhole

Conhur

SCALE 1 : 4000

NELSON

BELLS ISLAND WWTP
TOPOGRAPHICAL PLAN
9-10 June 2014

A3

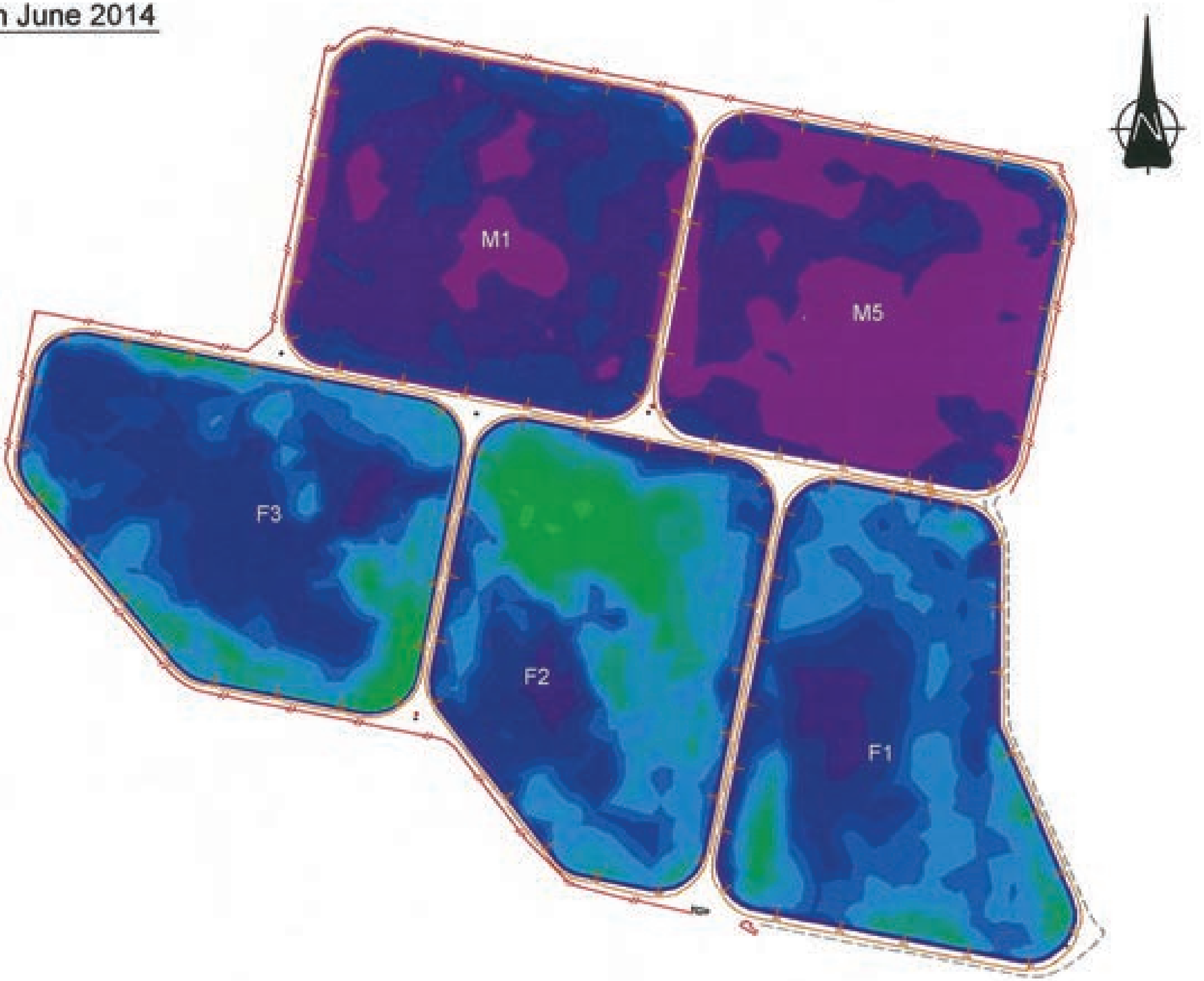
12433-02

1

0

POND VOLUMES as at 10th June 2014

F1 POND VOLUME	155,320 m³
F1 SLUDGE VOLUME	52,340 m³
F2 POND VOLUME	176,810 m³
F2 SLUDGE VOLUME	66,240 m³
F3 POND VOLUME	169,760 m³
F3 SLUDGE VOLUME	52,900 m³
M1 POND VOLUME	137,670 m³
M1 SLUDGE VOLUME	18,430 m³
M5 POND VOLUME	90,570 m³
M5 SLUDGE VOLUME	9,910 m³



Sludge Depth Table

Number	Minimum Sludge depth	Maximum Sludge depth	Color
1	0.000	0.100	
2	0.100	0.200	
3	0.200	0.300	
4	0.300	0.400	
5	0.400	0.500	
6	0.500	0.600	
7	0.600	0.700	
8	0.700	0.800	
9	0.800	0.900	
10	0.900	1.000	
11	1.000	1.100	
12	1.100	1.200	
13	1.200	1.300	
14	1.300	1.400	
15	1.400	1.500	
16	1.500	1.600	
17	1.600	1.700	
18	1.700	1.800	
19	1.800	1.900	
20	1.900	2.000	
21	2.000	2.100	
22	2.100	2.200	

Conhur

SCALE 1 : 4000

NELSON

BELLS ISLAND WWTP
SLUDGE DEPTH
9-10 June 2014

A3 | 12433-02 | 2 | 0

Conhur

CONHUR
34 Oakleigh Avenue
Tokoroa
PO Box 208021
Highbrook Mail Centre
East Tamaki
AUCKLAND 2161

GENERAL NOTES
1. Coordinates in terms of NZ Transverse Mercator (Metric)
2. Elevations in terms of Tokoroa Local (Approx.)
3. Contour interval is 1m

40 0 40 80 120 160 200m
SCALE 1 : 4000

NELSON

12433

1:4000

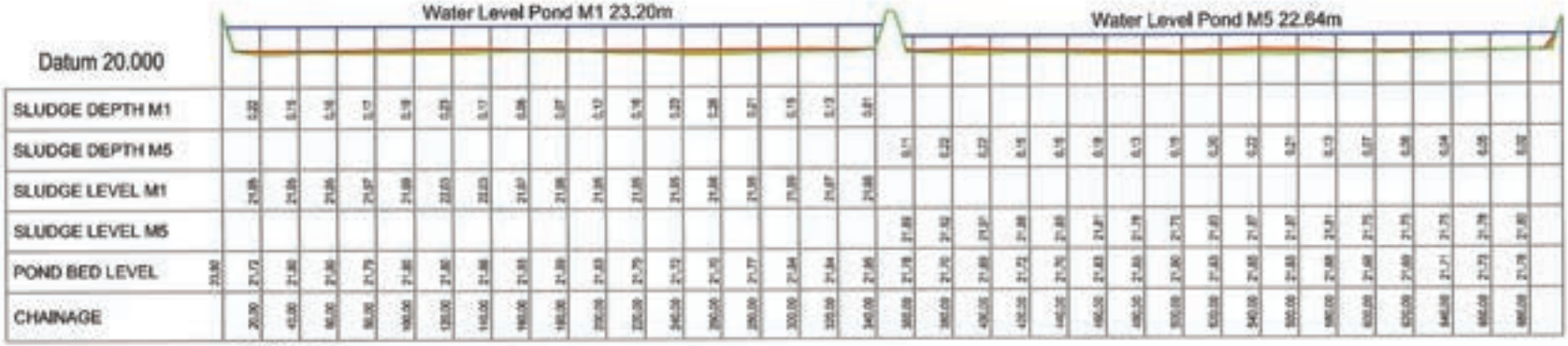
A3

BELLS ISLAND WWTP
PROFILE LAYOUT
9-10 June 2014

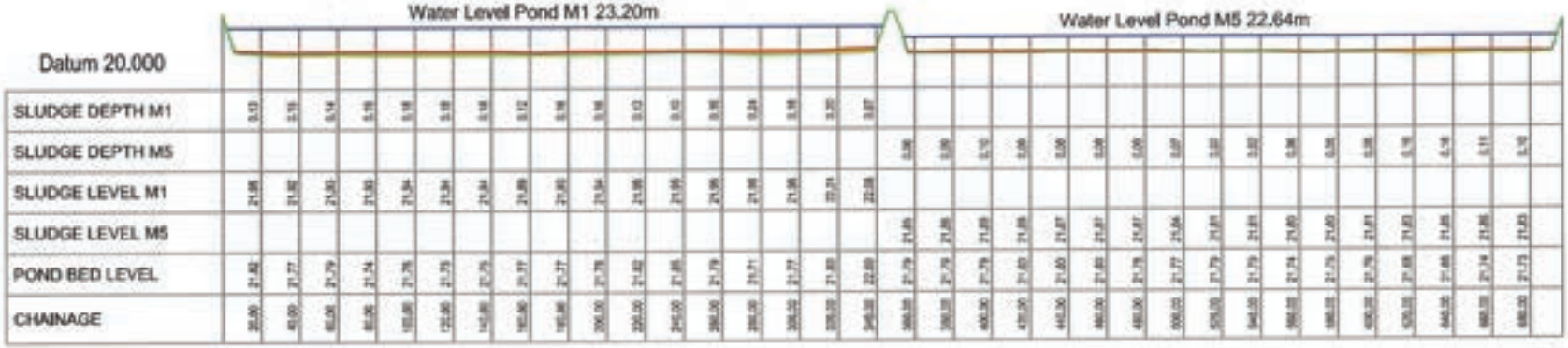
12433-02

3

0



PROFILE-1



PROFILE-2

Conhur

NELSON

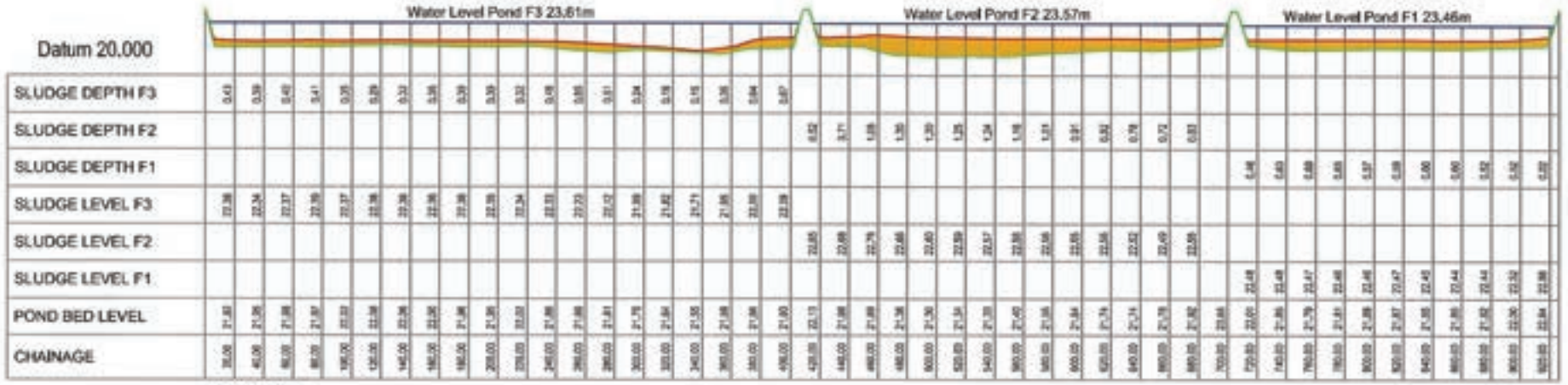
BELLS ISLAND WWTP
CROSS SECTIONS - Sheet 1
9-10 June 2014

A3

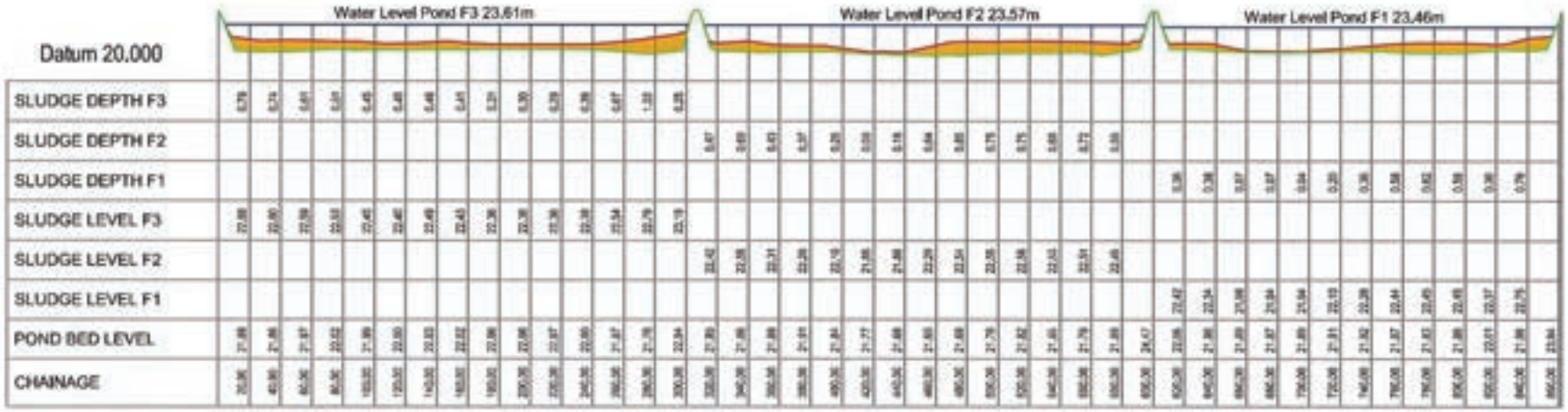
12433-02

4

0



PROFILE-3



PROFILE-4

Conhur

NELSON

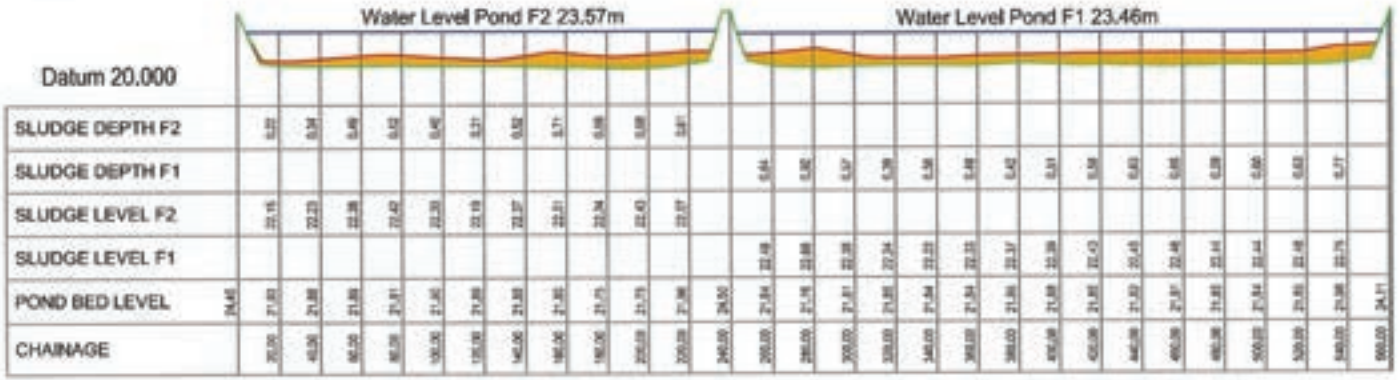
BELLS ISLAND WWTP
CROSS SECTIONS - Sheet 2
9-10 June 2014

A3

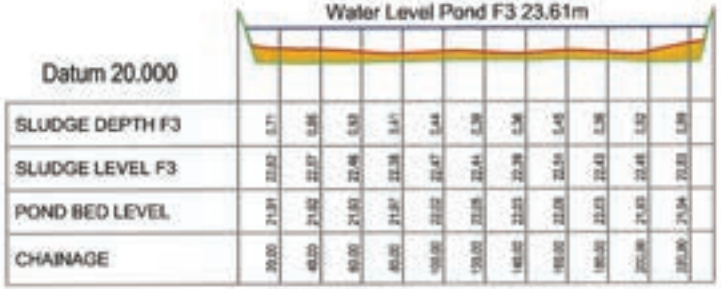
1:2433-02

5

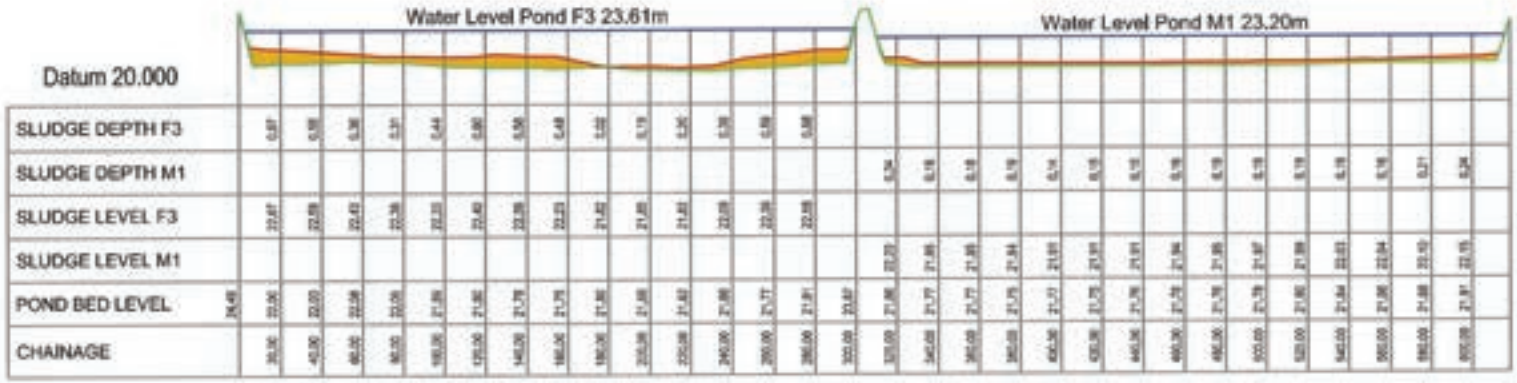
0



PROFILE-5



PROFILE-6



PROFILE-7

Conhur

CONHUR
34 Oakleigh Avenue
Tahunanui
PO Box 394021
Highbrook Mall Centre
East Tamaki
AUCKLAND 2161

GENERAL NOTES

1. Coordinates in terms of NZ Transverse Mercator (Approx.)
2. Elevations in terms of Mean Sea Level (Approx.)
3. Contour interval is 1m.

NELSON

12433

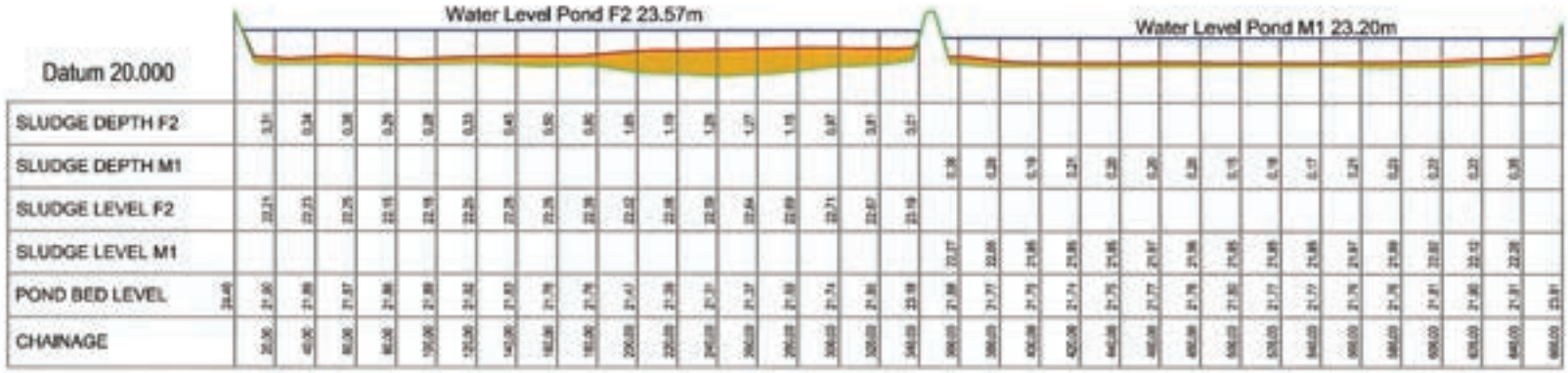
BELLS ISLAND WWTP
CROSS SECTIONS - Sheet 3
9-10 June 2014

A3

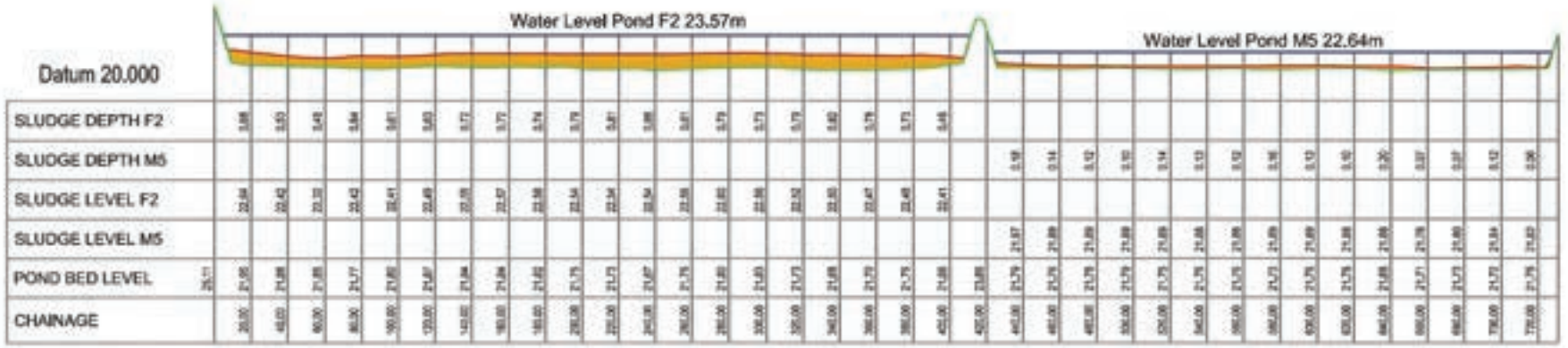
12433-02

6

0



PROFILE-8



PROFILE-9

Conhur

NELSON

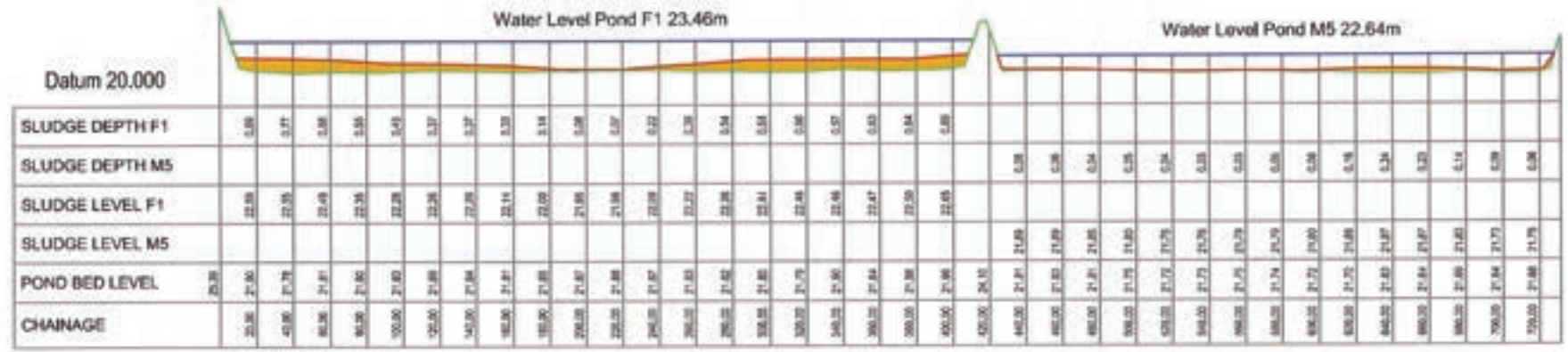
BELLS ISLAND WWTP
CROSS SECTIONS - Sheet 4
9-10 June 2014

A3

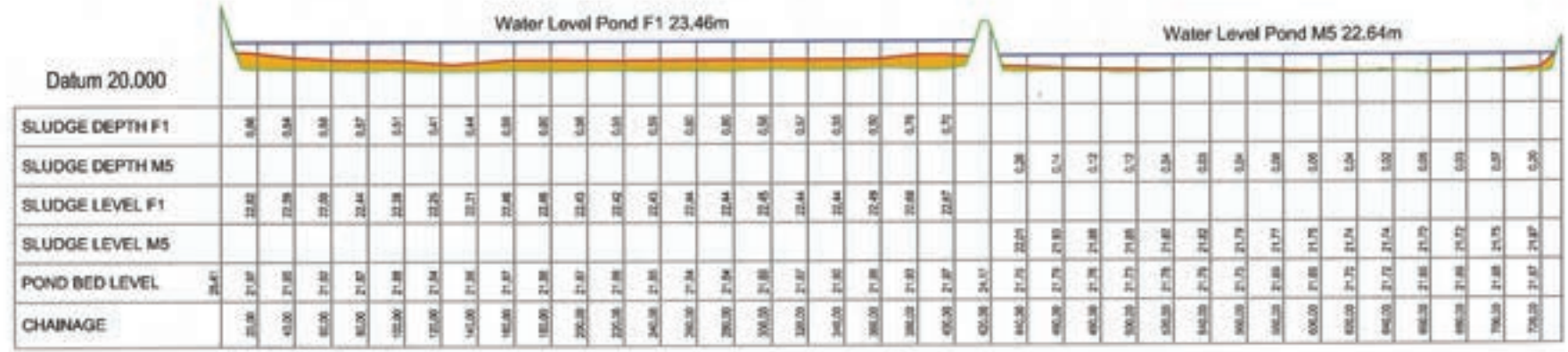
12433-02

7

0



PROFILE-10



PROFILE-11

HZ SCALE 1 : 2500

VERT SCALE 1 : 250

Conhur

NELSON

BELLS ISLAND WWTP
CROSS SECTIONS - Sheet 5
9-10 June 2014

A3

12433-02

8

0

Watercare
Laboratory Services

Auckland
52 Aintree Ave,
PO Box 107028,
Auckland Airport,
Auckland, 2150
Tel: (09) 539 7614
Fax: (09) 539 7601

Invercargill
142 Esk Street,
PO Box 747,
Invercargill, 9840
(03) 214 4040
(03) 214 4041

Queenstown
74 Glenda Drive,
PO Box 2614,
Wakatipu,
Queenstown, 9349
(03) 409 0559

www.watercarelabs.co.nz
clientsupport@water.co.nz

Certificate of Analysis
Laboratory Reference:140619-099

Attention:	Mark McLaughlin	*Final Report:*	**98537-0**
Client:	**CONHUR LTD**	*Report Issue Date:*	**27-Jun-2014**
Address:	**PO Box 204021, HIGHBROOK, 2161**	*Received Date:*	**19-Jun-2014**
Client Reference:	**Bells Island WWTP Nelson -Faculatative Pond F1**		
Purchase Order:	**19634**	*Quote Reference :*	**2865**

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-1**	**140619-099-2**	**140619-099-3**	**140619-099-4**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-1-1	F-1-2	F-1-3	F-1-4
General Testing					
Total Solids	%	3.7	4.5	4.5	5.2

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-5**	**140619-099-6**	**140619-099-7**	**140619-099-8**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-1-5	F-1-6	F-1-7	F-1-8
General Testing					
Total Solids	%	0.7	1.2	0.3	2.9

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-9**	**140619-099-10**	**140619-099-11**	**140619-099-12**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-1-9	F-1-10	F-2-1	F-2-2
General Testing					
Total Solids	%	3.1	2.8	3.8	3.5

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-13**	**140619-099-14**	**140619-099-15**	**140619-099-16**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-2-3	F-2-4	F-2-5	F-2-6
General Testing					
Total Solids	%	4.4	4.6	5.5	6.3

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-17**	**140619-099-18**	**140619-099-19**	**140619-099-20**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-2-7	F-2-8	F-2-9	F-2-10
General Testing					
Total Solids	%	5.2	5.1	4.6	2.5

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**140619-099-21**	**140619-099-22**	**140619-099-23**	**140619-099-24**
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-3-1	F-3-2	F-3-3	F-3-4

General Testing					
Total Solids	%	0.1	3.1	2.9	3.6

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-25	140619-099-26	140619-099-27	140619-099-28
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	10/06/2014	10/06/2014
Description:		F-3-5	F-3-6	F-3-7	F-3-8
General Testing					
Total Solids	%	4.0	3.3	2.9	2.8

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-29	140619-099-30	140619-099-31	140619-099-32
Client Sample ID:					
Sample Date/Time:		10/06/2014	10/06/2014	09/06/2014	09/06/2014
Description:		F-3-9	F-3-10	M-1-1	M-1-2
General Testing					
Total Solids	%	3.4	4.7	1.8	0.2

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-33	140619-099-34	140619-099-35	140619-099-36
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-1-3	M-1-4	M-1-5	M-1-6
General Testing					
Total Solids	%	1.1	0.2	0.2	0.2

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-37	140619-099-38	140619-099-39	140619-099-40
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-1-7	M-1-8	M-1-9	M-1-10
General Testing					
Total Solids	%	1.4	1.2	0.2	0.4

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-41	140619-099-42	140619-099-43	140619-099-44
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-5-1	M-5-2	M-5-3	M-5-4
General Testing					
Total Solids	%	2.2	0.1	0.3	4.0

Sample Details		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		140619-099-45	140619-099-46	140619-099-47	140619-099-48
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-5-5	M-5-6	M-5-7	M-5-8
General Testing					
Total Solids	%	0.5	0.2	2.4	0.9

Sample Details		SOLIDS	SOLIDS	WATERS	WATERS
Lab Sample ID:		140619-099-49	140619-099-50	140619-099-51	140619-099-52
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-5-9	M-5-10	M1 Comp 1	M5 Comp 1
Chemistry Summary View					
Ammoniacal Nitrogen (as N)	mg/L	-	-	41	47
Total Nitrogen (as N)	mg/L	-	-	300	420
General Testing					
Total Phosphorus (as P)	mg/L	-	-	38	53
Total Solids	%	0.2	3.0	-	-

Sample Details (continued)		SOLIDS	SOLIDS	WATERS	WATERS
Lab Sample ID:		140619-099-49	140619-099-50	140619-099-51	140619-099-52
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		M-5-9	M-5-10	M1 Comp 1	M5 Comp 1
General Testing					
Total Suspended Solids	mg/L	-	-	6100	11000
Volatile Solids	mg/L	-	-	4700	7100
Metals					
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	-	-	0.29	0.28
Cadmium (Total)	mg/L	-	-	0.011	0.016
Calcium (Total)	mg/L	-	-	74	120
Chromium (Total)	mg/L	-	-	0.74	1.2
Copper (Total)	mg/L	-	-	2.2	2.7
Lead (Total)	mg/L	-	-	0.66	1.4
Nickel (Total)	mg/L	-	-	0.48	0.85
Potassium (Total)	mg/L	-	-	33	42
Zinc (Total)	mg/L	-	-	4.3	5.6

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		140619-099-53	140619-099-54	140619-099-55	140619-099-56
Client Sample ID:					
Sample Date/Time:		09/06/2014	09/06/2014	09/06/2014	09/06/2014
Description:		F1 Comp 1	F1 Comp 2	F2 Comp 1	F2 Comp 2
Chemistry Summary View					
Ammoniacal Nitrogen (as N)	mg/L	120	120	180	170
Total Nitrogen (as N)	mg/L	730	850	960	880
General Testing					
Total Phosphorus (as P)	mg/L	130	130	230	240
Total Suspended Solids	mg/L	24000	21000	34000	38000
Volatile Solids	mg/L	16000	15000	23000	25000
Metals					
Total Metals by ICP-MS—Trace (Default Digest)					
Arsenic (Total)	mg/L	0.87	1.1	2.0	1.6
Cadmium (Total)	mg/L	0.073	0.055	0.13	0.14
Calcium (Total)	mg/L	250	210	440	450
Chromium (Total)	mg/L	2.8	2.8	5.6	5.5
Copper (Total)	mg/L	13	12	26	25
Lead (Total)	mg/L	1.8	1.2	4.3	7.5
Nickel (Total)	mg/L	1.3	0.82	1.8	2.1
Potassium (Total)	mg/L	49	47	74	71
Zinc (Total)	mg/L	27	22	47	46

Sample Details		WATERS	WATERS
Lab Sample ID:		140619-099-57	140619-099-58
Client Sample ID:			
Sample Date/Time:		09/06/2014	09/06/2014
Description:		F3 Comp 1	F3 Comp 2
Chemistry Summary View			
Ammoniacal Nitrogen (as N)	mg/L	56	57
Total Nitrogen (as N)	mg/L	420	430
General Testing			
Total Phosphorus (as P)	mg/L	150	190
Total Suspended Solids	mg/L	25000	27000
Volatile Solids	mg/L	18000	19000
Metals			
Total Metals by ICP-MS—Trace (Default Digest)			
Arsenic (Total)	mg/L	1.3	1.5
Cadmium (Total)	mg/L	0.070	0.10
Calcium (Total)	mg/L	260	350
Chromium (Total)	mg/L	3.3	4.4
Copper (Total)	mg/L	14	20
Lead (Total)	mg/L	1.6	2.7
Nickel (Total)	mg/L	1.0	1.8

Sample Details (continued)		WATERS	WATERS
Lab Sample ID:		140619-099-57	140619-099-58
Client Sample ID:			
Sample Date/Time:		09/06/2014	09/06/2014
Description:		F3 Comp 1	F3 Comp 2
Metals			
Total Metals by ICP-MS—Trace (Default Digest)			
Potassium (Total)	mg/L	52	61
Zinc (Total)	mg/L	27	36

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Summary View				
Ammoniacal Nitrogen (as N)	APHA (2012) 4500-NH3 G (Modified)	0.005 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Total Nitrogen (as N)	APHA (2012) 4500-P J, 4500-NO3 F (Modified)	0.02 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
General Testing				
Total Phosphorus (as P)	APHA (2012) 4500-P B, J (Modified)	0.005 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Total Solids	APHA (2012) 2540 G	%	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	Auckland
Total Suspended Solids	APHA (2012) 2540 D, E	1 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Volatile Solids	APHA (2012) 2540 D, E	1 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Metals				
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	US EPA 200.8 (Modified)	0.00010 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Cadmium (Total)	US EPA 200.8 (Modified)	0.00005 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Calcium (Total)	US EPA 200.8 (Modified)	0.010 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Chromium (Total)	US EPA 200.8 (Modified)	0.00010 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Copper (Total)	US EPA 200.8 (Modified)	0.0002 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Lead (Total)	US EPA 200.8 (Modified)	0.00010 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Nickel (Total)	US EPA 200.8 (Modified)	0.00010 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Potassium (Total)	US EPA 200.8 (Modified)	0.1 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Zinc (Total)	US EPA 200.8 (Modified)	0.001 mg/L	51, 52, 53, 54, 55, 56, 57, 58	Auckland
Preparations				
Digest for Total Metals in Liquids	APHA (2005) 3030A (modified, 4:1 Nitric: Hydrochloric Acid)		51, 52, 53, 54, 55, 56, 57, 58	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

IANZ ACCREDITED LABORATORY

Tests indicated as not accredited are outside the scope of the laboratory's accreditation

Report Signatory 27/06/2014

Carol Taylor
KTP Signatory